Grassland restoration and management
to increase landscape biodiversity

Szabolcs Lengyel, Eszter Déri, Balázs Deák*, Roland Horváth, Tibor Magura*, Béla Tóthmérész
University of Debrecen and *Hortobágy National Park Directorate, Hungary
E-mail: szabolcs@delfin.unideb.hu, Web: http://life2004.hnp.hu

Introduction

• Grassland restoration is one of the most frequent land use change on cropland abandoned due to climate change and intensification (1).
• Most studies of grassland restoration typically focus on one taxon at small spatial scales (24) or several taxa at large (continental) scales (5-6).
• Relatively few studies have explored the links between grassland restoration and landscape-level biodiversity (7-9).

Aim and background

We study the impact of grassland restoration and management on species diversity of multiple taxa at the landscape scale.

Hypothesis 1:
Restoration increases the diversity of plants and arthropods characteristic to natural habitats.

Hypothesis 2:
Low-diversity seed mixtures lead to more open niches, different successional pathways and higher biodiversity.

Our study system is the Egyek-Pusztakőcs area (Hortobágy National Park, E-Hungary), one of the largest (> 4000 ha) and oldest habitat restoration projects in Europe.
• Marsh restoration took place between 1976 and 1996.
• The current (2004-08) phase focuses on the restoration and management of grasslands.

This project is co-financed by EU LIFE-Nature, the financial instrument for managing Natura 2000 sites of European conservation importance.

Methods

Grassland restoration on 500 ha in 2005-2007:
• target habitats: Pannonian alkali grasslands and marshes, Pannonian loess steppes (priority habitats in EU)
• previous crop: wheat or alfalfa
• low-diversity seed mixtures: alkali: 2 grasses, loess: 3 grasses

Monitoring of changes:
• repeated measures design (different starting years)
• space-for-time design (same-year comparisons)
• taxa: flowering plants, arthropods (grasshoppers Orthoptera, ground beetles Carabidae, spiders Araneae, and others)

Results - plants

Fig. 1. In Year 1, plant community composition differed both by (A) previous crop and (B) seed mixture

Fig. 2. From Year 1 to Year 2, overall plant species composition changed and differences by seed mixture remained

Table 1. Changes in species composition from Year 1 to Year 2

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>St of ‘natural’ species</td>
<td>9 ± 2.2</td>
<td>11 ± 3.2</td>
<td>9 ± 2.2</td>
<td>11 ± 3.2</td>
</tr>
<tr>
<td>Annuals, %</td>
<td>65 ± 4.5</td>
<td>17 ± 5.2</td>
<td>83 ± 3.4</td>
<td>7 ± 1.3</td>
</tr>
<tr>
<td>Dicot phytomass, g m⁻²</td>
<td>1020.2</td>
<td>542.0</td>
<td>989.0</td>
<td>6.4</td>
</tr>
</tbody>
</table>

Summary - Plants

• Weed community composition in Year 1 differed by previous crop and seed mixture (Fig. 1), likely due to differences in soil seed bank.
• Marked changes in species composition occurred from Year 1 to Year 2 (Fig. 2), with total species richness decreasing (Table 1).
• Most changes were due to the increase of ‘natural’ species, either from the seed bank or through colonization, and to the decrease of annual dicot weeds (Table 1).

Results - arthropods

Fig. 3. Species richness fluctuated per arthropod group among years. Diversity differences between crops in Year 0 disappeared by Year 2.

Fig. 4. Arthropod assemblages became more similar to those in native grasslands from Year 1 to Year 2

Fig. 5. Although total species richness did not vary (A), the diversity of arthropods characteristic to native grasslands increased from Year 1 to Year 2 (B)

Summary - Arthropods

• Taxon species richness fluctuated between years (Fig. 3). In Year 1, a few generalist species dominated, and assemblages did not differ by seed mixture (not shown).
• Differences in species richness by previous crop in Year 1 disappeared by Year 2 (Fig. 3).
• Total species richness did not change (Fig. 5A), while assemblages became more ‘natural’ by Year 2 (Fig. 4) due to the colonization of ‘natural’ species (Fig. 5B).

Conclusions

Year 2 was an important turning point in restoration because
• the diversity of ‘natural’ plants increased,
• new plant communities differed in species composition,
• the diversity of ‘natural’ arthropods increased.

Hypothesis 1 - supported
grassland restoration on croplands increased diversity of plants and animals characteristic to target native grasslands

Hypothesis 2 - supported
low-diversity seedling led to different successional pathways depending on previous history (via soil seed bank) and seed mixture (via colonization).

References